PATENT SPECIFICATION

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789,581

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COMPLETE SPECIFICATION

Coating Composition Atomizing Head

We, SCHWEITZER ELECTROSTATIC COMPANY, a corporation organised under the laws of Ohio, United States of America, of 3764 Ridge Road, Cleveland 9, Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to coating operations involving atomisation of the coating composition, and more particularly to an atomising head for effecting this atomisation.

Solvent loss is one of the greatest single cost factors in coating operations involving atomisation. To be able to effectively atomise and disperse solvent coating compositions such as paints, it is necessary to reduce paint viscosity by increasing solvent content. After the coating operation is completed, the coating dries and the solvent volatilises and is thereby either lost to the atmosphere or recovered from the environmental drying air by elaborate solvent recovery arrangements. In either case, the corollary of high solvent content is the high cost of solvent loss or the somewhat less cost of solvent recovery procedures.

In hot melt coating operations, the requirement of maintaining a sufficiently low viscosity for atomisation is met by heating the liquid coating composition at elevated temperatures. To maintain these elevated temperatures on a continuous basis is expensive. Moreover, the necessary high temperature of the coating composition precludes its use in processes in which the permissible temperature of the coating operation is restricted by the temperature tolerance of the object to be coated or by other limitations.

The necessity of constantly providing a continuously consumed supply of high pressure air is another important cost factor in coating operations involving atomisation. The considerable energy represented by the continuous supply of high pressure air is required in conventional atomising heads to do the work of overcoming coating cohesion and surface tension in order to transform the liquid coating composition into a finely divided discontinuous mist.

It is the object of the invention to provide a head for atomising coating compositions which may be held at substantially environmental temperature and in which the solvent content may be reduced below that previously required in atomising operations.

According to the present invention a coating composition atomising head comprises a body assembly containing an elongated chamber which is open at one end, a needle tapering from a relatively wide shank to a relatively narrow point mounted within the chamber with the point adjacent the open end, the needle, when in operation, being supported only at or near the end of the shank, a transducer associated with the needle for vibrating the needle ultrasonically, and a connection for introducing liquid coating composition into the chamber and onto the surface of the needle so that the composition is atomised at the surface of the needle when the needle is vibrated.

It has been discovered that the pointed vibrating needle lends itself to the technique of deposition of an electro-static charge upon a coating composition which is undergoing atomisation, and thus according to a further feature of the invention, the needle is provided with an electrical lead for connection to a source of high electrical potential, whereby corona discharge is caused to take place from the point of the needle to impart a static charge to the coating composition atomised by the needle.

An example of an atomising head constructed in accordance with the invention is illustrated in the accompanying drawings in which:—

Figure 1 is a longitudinal section through the atomising head, the relative positions of the parts being those of the inoperative or "off" condition.

Figure 2 is a view similar to Figure 1 showing the relative positions of the parts when the atomising head is in the operative or "on" condition.

As illustrated in the drawings, a body 10 receives a threaded plug 11, which in its installed position, seats in sealing relationship on a plug seat 12. A bore 13 of the plug 11, together with a stepped bore 14 of the body 10, defines an elongated chamber having an open end 15. A cap 16 fits over the plug 11 and is threaded to the body 10 to define an air manifold chamber 17. Extending rearwardly of the bore 14 is a narrow bore 20 and counterbore 21. The bore 20 opens into a rear chamber 22 which is closed by a suitable cap 23.

Slidably received in a narrow portion 25 of the bore 14 is a sleeve 30 preferably fabricated from material known by the Registered Trade Mark 'Bakelite,' the Registered Trade Mark 'Catalin,' lead or other material of very small ultrasonic transmission. The sleeve 30 in turn receives a press-fitted ultrasonic transducer 31, preferably a barium titanate transducer having silver plated front and rear faces 32 and 33 and which is hexagonal in cross-section. The rear face 33 engages a small annular shoulder 34 formed on the sleeve 30 and faces an air gap chamber 35 which reduces rearward energy loss and damping. The central portion of the sleeve bore may also be relieved as at 36 to further reduce damping.

The front face 32 of the transducer 31 is cemented to a shank portion 41 of a needle 40. The needle tapers downwardly from its shank portion to a narrow tip 42 which extends through the open end 15. An upper portion 43 of the needle is adapted to mate with a seat 45 of the plug 11.

A hollow stem 50 is threadedly received in a boss 51 formed on the rear of the sleeve 30. The stem 50 extends through the narrow bore 20 into the chamber 22. A piston assembly 52 including an air-seal ring 53 is mounted on the rearward end of the stem 50. Extending through the hollow center of the stem 50 is a cable 61, the inner end of which is stripped to expose a conductor 62 which is soldered to the silvered rear face 33 of the transducer 31. The cable 61 extends beyond the hollow stem 50 and through a hollow boss 63 formed on the cap 23.

A coil spring 65 is compressed between the cap 23 and the piston assembly 52 to constantly urge moving parts of the needle assembly to the left or closed or "off" position. A plug 70 surrounds the stem 50 and is received in the body 10. The plug 70 is adapted to be tightened against the packing 71 to prevent leakage in either direction along the stem 50. Another plug 75 is received in the bore portion 14 of the body 10. The plug 75 is in sliding contact with the forward silver plated end face 32.

The atomising assembly includes three inlet connections 80, 81 and 82. The inlet 80 communicates with the air manifold 17, which in turn, communicates with the plug bore 13 through plug passages 84. The inlet 81 communicates with the body bore 14. The inlet 82 communicates through passage 86 with the chamber 22.

A source of high electric potential or a power pack is connected to the needle 40 through a lead 91 which is sufficiently flexible to move with the needle 40 through slight translational movement. Leakage of coating composition from the body bore 14 through the passage in which extends the cable containing the lead 91 is prevented by suitable removable sealing grommets 92, which, when in position, easily withstand the relatively low pressure of coating composition within the body bore 14.

Operation

The atomising head is initially actuated by high pressure air received in the inlet connection 82. An "on-off" air valve (not shown) controlling admission of air at this inlet is coupled to an electric switch (not shown) in any conventional manner so that high frequency current is supplied to the cable 61 upon actuating of the piston 52. As will be apparent to those familiar with high-frequency vibrator drives, the power to vibrate the transducer 31 may be produced by any suitable high-frequency oscillator. Circuit potential is applied at the rear face 33 of the transducer through the conductor 62. Ground return from the opposite face 32 of the transducer is accomplished through the sliding contact of the periphery of the face 32 and the needle shank portion 41 against the bore of the plug 75.

When the piston 52 is moved rearwardly by air pressure, it carries with it the needle mounting assembly including the stem 50, the sleeve 30, the transducer 31 and the needle 40. This movement stops when the boss 51 is seated against the rear shoulder of the counterbore 21. The needle 40 is thereby lifted off the plug seat 45 allowing liquid coating composition, admitted through the inlet connection 81, to pass down along the tapered sides of the needle. The now ultrasonically vibrating needle lowers the viscosity of the coating composition and breaks the coating composition up into a fine airborne dispersion. The dispersed coating composition then passes out through the open end 15, this movement being preferably sided by low pressure air admitted through the passages 84. Exhaustion of the atomised coating composition may also be augmented by the aspirating action of air expelled through ports 90 which are in communication with the air manifold chamber 17.

The air-emulsification and exhaustion of the coating composition is a continuous process. No high pressure air is required to do the work of atomisation. Exhaustion of the coat-

ing composition may be augmented by very small air pressure differentials, and the function of any air which may be continuously admitted through the inlet connection is merely to aid in such exhaustion. Thus, the air requirements of the spray head are small.

It will be apparent that the head is turned off by releasing pressure at the inlet 82 allowing the needle mounting assembly to be shifted to the left by the spring 65 so that the needle seats against the seat 45. Upon this release of pressure the electric switch which is coupled to the "on-off" air valve is opened so that the transducer 40 is no longer driven by the oscillator circuit as the needle seats.

When electrostatic coating is being carried out, high potential is supplied through the lead 91 to cause a corona discharge to occur from the pointed tip 42 of the needle, as will be apparent to those familiar with the art of electrostatic coating. The projection of electrostatically charged particles of coating material is greatly enhanced by accomplishing atomisation of the paint with a vibrating needle as disclosed above, rather than by the use of conventional means for mechanically feeding or atomising from a charged spray-head member a liquid to be used in electrostatic coating processes.

What we claim is:—

1. A coating composition atomising head comprising a body assembly containing an elongated chamber which is open at one end, a needle tapering from a relatively wide shank to a relatively narrow point mounted within the chamber with the point adjacent the open end, the needle, when in operation, being supported only at or near the end of the shank, a transducer associated with the needle for vibrating the needle ultrasonically, and a connection for introducing liquid coating composition into the chamber and onto the surface of the needle so that the composition is atomised at the surface of the needle when the needle is vibrated.

2. An atomising head according to claim 1, further comprising a connection for supplying air under pressure to assist in the expulsion of atomised coating composition through the open end of the chamber.

3. An atomising head according to claim 1 or claim 2, in which the elongated chamber comprises a spray chamber through which the needle extends and which communicates through a port with a liquid chamber, the needle projecting through the port and having a portion adjacent the shank which co-operates with the port, the needle being movable between a position in which the port is closed by the needle and an operating position in which the port is open, so that the coating composition can flow from the introduction connection into the liquid chamber and thence through the port into the spray chamber along the surface of the needle.

4. An atomising head according to claim 3, in which the needle is movable into the position in which the port is opened against the action of a spring by air pressure acting on a piston connected to the needle.

5. An atomising head according to any one of claims 1 to 4, in which the needle is provided with an electrical lead for connection to a source of high electrical potential, whereby corona discharge is caused to take place from the point of the needle to impart a static charge to the coating composition atomised by the needle.

6. An atomising head according to claim 1, having its parts constructed and arranged substantially as described with reference to the accompanying drawings.

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789,581 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

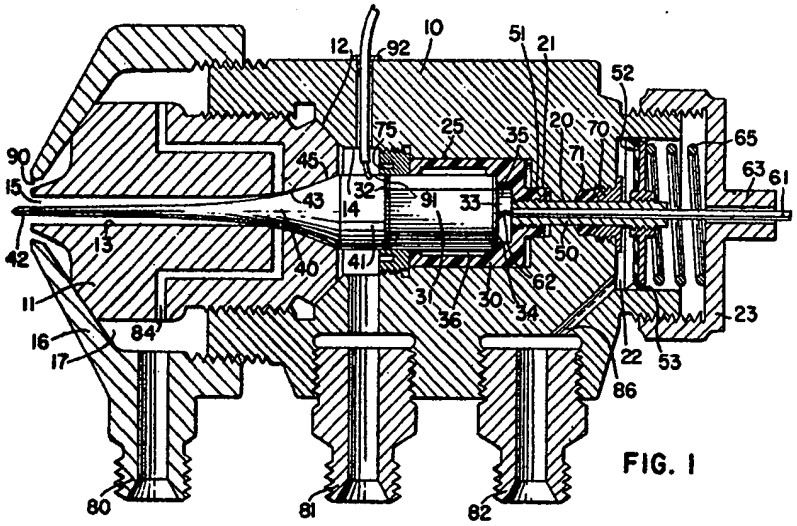

FIG. 1

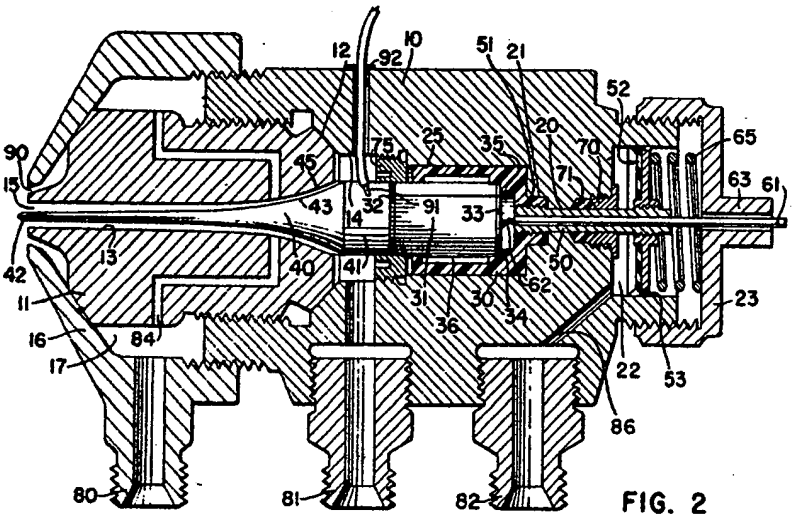

FIG. 2